

PATENT SPECIFICATION

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(54) CRACK DETECTION MEANS

(71) We, MOTOREN-UND TURBINEN-UNION MÜNCHEN, GMBH, of Dachauer Strasse 665, 8000 München 50, Germany, a German Company, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

In the Specification of prior Patent No. 1239349, to which the present Application is an addition, there is disclosed a combination of a turbo-blade having a resistance wire embedded therein with an electric circuit connected to said wire and operative to detect a change of resistance in the wire due to a crack in the blade. Hereinafter this known combination will be referred to as "a combination of the kind defined".

The Specification of prior Patent No. 1239349 thus relates to crack detection means for a turbo machine for early detection of turbo-blade failure caused by incipient cracks, in which the change in resistance of the wire embedded in the blade, due to a crack in the blade, is detected by the electric signal circuit. Such a resistance wire preferably extends through blade areas most susceptible to cracking and acts to break the electric circuit when a crack develops in the blade and thus initiate a signal to give warning of impending damage.

It has become apparent that the crack detection means disclosed in the Specification of prior Patent No. 1239349 is not only useful for turbo machines, but is also useful generally for monitoring component parts which under tensile or alternating loads are subject to damage as a result of forced or brittle fracture, whereby when such damage is detected complete separation throughout the whole of the cross section can be prevented.

Accordingly the present invention provides a combination of the kind defined, wherein the turbo-blade is replaced by any other structural member or component part subject to incipient cracking, the resistance wire being

adapted and embedded in such manner that the incipient cracking will break the resistance wire, the electrical circuit being operative to detect a change in resistance in the wire due to the breaking thereof whereby the incipient cracking can be detected without complete separation of the structural member or component throughout its whole cross-section.

Thus, due to the extremely high resistance in the electrical circuit as a result of breaking of the resistance wire, incipient cracking due to an excessively high load exceeding the normal permissible loading on the component can be detected before complete separation, and therefore destruction, of the component takes place. Clearly, as soon as breaking of the resistance wire is mounted by the electrical circuit, the loading on the component can be reduced immediately so that complete destruction of the component can be prevented.

With the invention a resistance wire communicating with a warning device can be incorporated in generally any component part, including shafts, axles and pressure vessels. In the case of shafts the resistance wire preferably extends through a region of the shaft most prone to cracking, that is, through the outer region where fatigue failure will normally originate. As incipient cracks in pressure vessels propagate primarily in the longitudinal direction, the resistance wire is preferably embedded circumferentially in the casing shell to facilitate crack location.

The present invention is not necessarily limited to component parts generally involved in mechanical engineering. The crack detection means can equally well be useful in structural engineering, as in a steel concrete member where the formation of incipient cracks is a similarly typical indication of ultimate failure. Installation of a crack detection means of this invention may thus give warning of impending cave-ins and so in buildings prevent injury to residents.

For a better understanding of the present invention and to show how the same may be

carried into effect, reference will now be made, by way of example, to the accompanying single figure drawing which shows schematically an example of a crack detection means applied to a pressure vessel.

The drawing shows a pressure vessel 10 incorporating in its shell a plurality of circumferentially arranged resistance wires 11 communicating with an indicating unit 12 which unitarily collects the various signal circuits formed by the wires 11.

It is apparent that modifications other than that described and illustrated herein may be made to the apparatus of this invention without departing from the scope of the invention as defined in the appended claims. Thus, in order to detect and conceivably locate variously oriented cracks in component parts under variously oriented loads, a plurality of wires may be embedded in the material of the component part in either of two mutually independent, variously oriented layers. The resistance wires for the signal circuits may thus be incorporated in randomly selected directions and planes of the component part, or in any other way affording ready crack location.

When an incipient crack occurs the resistance wire or wires will break, the resulting high resistance being detected by the electrical indicating unit which then provides a warning that the loading on the component has exceeded a permissible level so that measures can be taken immediately to prevent complete destruction of the component.

WHAT WE CLAIM IS:—

1. A combination of the kind defined, wherein the turboblade is replaced by any other structural member or component part subject to incipient cracking, the resistance wire being adapted and embedded in such manner that the incipient cracking will break the resistance wire, the electrical circuit being operative to detect a change in resistance in the wire due to the breaking thereof whereby the incipient cracking can be detected without separation of the structural member or component throughout its whole cross-section.

2. A combination according to claim 1 having a plurality of resistance wires embedded in the material of the structural member or component part in two mutually independent and variously oriented layers.

3. A combination according to claim 1 or claim 2, wherein a plurality of resistance wires each forming a signal circuit and terminating in a common indicating unit are circumferentially routed through the shell of a pressure vessel.

4. A combination substantially as herein before described with reference to the accompanying drawing.

HASELTINE, LAKE & CO.,

Chartered Patent Agents,

Hazlitt House,

28, Southampton Buildings, Chancery Lane,

London WC2A 1AT and

9 Park Square, Leeds LS1 2LH,

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COMPLETE SPECIFICATION

1 SHEET

*This drawing is a reproduction of
the Original on a reduced scale*

